

# MATHEMATICS STANDARDS BY LEVEL

## FOUNDATIONS (Grades 1-3)

### ***STANDARD 1: NUMBER SENSE***

Students develop number sense and use numbers and number relationships to acquire basic facts, to solve a wide variety of real-world problems, and to determine the reasonableness of results.

- **1M-F1. Represent and use numbers in equivalent forms through the use of physical models, drawings, word names and symbols (e.g., using concrete materials and fraction equivalents to represent and compare halves, thirds, fourths, eighths and tenths)**

- PO 1. Make a model to represent a given whole number
- PO 2. Identify a whole number represented by a model with a word name and symbol
- PO 3. Construct equivalent forms of whole numbers (e.g.,  $15 + 5 = 10 + 10$ )
- PO 4. Make a model to represent a given fraction (e.g., geometric model—shading a picture, set model—part of an egg carton) (halves, thirds and fourths)
- PO 5. Identify the fraction represented by a model with a word name and symbol (halves, thirds and fourths)
- PO 6. Identify a given model that is divided into equal fractional parts (halves, thirds and fourths)

- **1M-F2. Relate counting, grouping and place-value concepts to whole numbers (e.g., reading and writing the number represented when objects are grouped by thousands, hundreds, tens and ones)**

- PO 1. Read whole numbers up to one thousand
- PO 2. Write whole numbers up to one thousand
- PO 3. Order whole numbers (e.g., smallest to largest, largest to smallest) up to one thousand
- PO 4. Construct a model to represent place value concepts
- PO 5. Write whole numbers in expanded notation (e.g.,  $531 = 500 + 30 + 1$ )
- PO 6. Read aloud a whole number with correct place value words (e.g., a student will read 5 2 1 as “five hundred twenty-one”)
- PO 7. Count money to \$5.00 using bills and coins

- **1M-F3. Understand the meaning for and application of the operations of addition, subtraction, multiplication and division**

- PO 1. Demonstrate with models to show the process used in addition (joins things together, increases)
- PO 2. Demonstrate with models to show the process used in subtraction (takes away, compares, finds the difference, decreases)
- PO 3. Demonstrate with models to show the process used in multiplication (uses repeated addition, counts by multiples, combines things that come in groups of equal size, makes arrays, uses area models)
- PO 4. Demonstrate with models to show the process used in division (puts things into groups of equal size, shares equally, uses repeated subtraction)
- PO 5. Demonstrate with models the operations of addition and subtraction up to two three-digit whole numbers
- PO 6. Select appropriate operations to solve word problems
- PO 7. Solve word problems using the appropriate operations
- PO 8. Apply mathematical operations in everyday situations

- **1M-F4. Demonstrate proficiency with the operations of addition and subtraction of whole numbers**

*Note: Proficiency: accurate and consistent solving of computational problems in a reasonable time, using self-checking skills*

- PO 1. Demonstrate proficiency with basic facts up to 20
- PO 2. Add and subtract two three-digit whole numbers
- PO 3. Solve problems using a variety of mental computations and estimation

- **1M-F5. Demonstrate proficiency with the operations of multiplication and division of single-digit numbers**

- PO 1. Demonstrate proficiency with basic facts up to the fives
- PO 2. Solve problems using a variety of mental computations and estimation

- **1M-F6. Add and subtract commonly used fractions and decimals**

- PO 1. Demonstrate with models addition and subtraction of fractions with common denominators (halves, thirds and fourths)
- PO 2. Add and subtract money up to \$5.00

- **1M-F7. Select and use appropriate techniques to facilitate computation (e.g., mental, estimation, paper-and-pencil, calculator and computer methods) while solving problems and determining the reasonableness of results**

- PO 1. Select a computational technique to solve a problem
- PO 2. Solve a problem using the appropriate computational techniques
- PO 3. Evaluate the reasonableness of results using a variety of mental computation and estimation techniques (e.g., compatible numbers, front-end, chunking)
- PO 4. Use technology (e.g., calculators, computers, multimedia) to solve problems containing larger numbers

## ***STANDARD 2: DATA ANALYSIS AND PROBABILITY***

Students use data collection and analysis, statistics, and probability to make valid inferences, decisions and arguments and to solve a variety of real-world problems.

- **2M-F1. Collect and analyze data using the concepts of largest, smallest, most often, least often and middle**

- PO 1. Collect and record data from surveys (e.g., favorite color or food, height, ages) or experiments
- PO 2. Organize (e.g., sorting, sequencing, tallying) information from surveys or experiments
- PO 3. Identify largest, smallest, most often recorded (i.e., mode), least often and middle (i.e., median) using sorted data
- PO 4. Formulate questions from organized data

- **2M-F2. Construct, read and interpret displays of data to make valid decisions, inferences and predictions**

- PO 1. Make and label a graph (horizontal bar, vertical bar, picture graph or tally chart) from organized data
- PO 2. Answer questions about a circle graph (i.e., pie graph) divided into halves and fourths
- PO 3. Answer questions about a pictograph where each symbol represents multiple units
- PO 4. Write a title representing the main idea of a graph
- PO 5. Locate points on a line graph (grid) using ordered pairs
- PO 6. Draw conclusions (e.g., valid decisions, conjectures and predictions) from graphed data
- PO 7. Formulate questions from graphs, charts and tables
- PO 8. Solve problems using graphs, charts and tables (e.g., given a bar graph of preferred flavors of ice cream, students have to decide what flavors of ice cream to order)

- **2M-F3. Predict and measure the likelihood of events and recognize that the results of an experiment may not match predicted outcomes**

*Note: Probability experiments are simple one-step activities, e.g., tossing a two-colored counter*

- PO 1. Collect and record data from a probability experiment
- PO 2. Organize (e.g., sorting, sequencing, tallying) data from a probability experiment
- PO 3. Name the possible outcomes of the probability experiment
- PO 4. Predict the most likely or least likely outcome in probability experiments
- PO 5. Compare the outcome of the experiment to the predictions

- **2M-F4. Understand the concept of sample (i.e., that a larger sample of observed outcomes leads to more reliable information)**

- PO 1. Compare data from probability experiments where the experiments are performed a different number of times with the given expected outcomes (e.g., toss a two-colored counter 10 times and record the data; toss the counter 20 times and record the data; compare the results to the expected outcome [1 out of 2])

### ***STANDARD 3: PATTERNS, ALGEBRA AND FUNCTIONS***

Students use algebraic methods to explore, model and describe patterns, relationships and functions involving numbers, shapes, data and graphs within a variety of real-world problem-solving situations.

- **3M-F1. Create, describe and extend a variety of patterns using shapes, events, designs and numbers**

*Note: Types of patterns: manipulatives, symbols, words, numbers and pictures*

- PO 1. Create a pattern using a model (e.g., symbolically: numbers or letters; visually: shapes, designs, numbers or pictures; auditorially: clapping, singing or listening; and kinesthetically: dancing, movement or tactile)
- PO 2. Communicate orally or in written form the repetition of objects in a pattern
- PO 3. Communicate orally or in written form a given pattern occurring in a sequence of numbers (e.g., counting by 10's, 5's, 3's, 2's, odd, even, forward and backward)
- PO 4. Extend patterns using a model
- PO 5. Extend a given pattern occurring in a sequence of numbers

- **3M-F2. Formulate generalizations about patterns (e.g., color, shape, size, direction, orientation) to make predictions**

- PO 1. Make predictions based on a given pattern

- **3M-F3. Represent and describe how changing the value of one variable results in a change in another**

PO 1. Describe in a given situation how a change in one variable results in the change of another (e.g., if you have to share a batch of cookies with friends, the more friends you have, the fewer cookies you'll each get)

- **3M-F4. Represent and describe mathematical relationships such as order, grouping, etc. (e.g., given a string of numbers, describe the pattern, define the relationship between the numbers and determine the next number in line)**

PO 1. Identify the pattern in skip counting

PO 2. Determine the next number in a skip counting pattern

- **3M-F5. Recognize the symbols of equality and inequality**

PO 1. Use the symbols  $<$ ,  $>$ ,  $=$  to compare whole numbers

- **3M-F6. Find missing elements in number sentences**

PO 1. Find the missing number in addition and subtraction number sentences

#### ***STANDARD 4: GEOMETRY***

Students use geometric methods, properties and relationships as a means to recognize, draw, describe, connect, and analyze shapes and representations in the physical world.

- **4M-F1. Relate geometric concepts to number and measurement ideas (e.g., dividing a rectangle into parts to represent multiplication)**

*Note:*

- two-dimensional shapes: square, rectangle, triangle, circle
- three-dimensional figures: sphere, cube, rectangular prism (box), cone, pyramid
- attributes: size; shape; the number of sides, corners and faces

PO 1. Identify two-dimensional shapes by name and attribute

PO 2. Draw two-dimensional shapes

PO 3. Identify three-dimensional figures by name and/or attribute

PO 4. Compare attributes of two-dimensional shapes

PO 5. Compare attributes of three-dimensional figures

PO 6. Use a rectangular array to represent a multiplication fact (e.g., put 12 tiles in a rectangular array; make a  $3 \times 4$ ,  $6 \times 2$ , and  $12 \times 1$  array)

- **4M-F2. Predict how shapes can be changed by combining or dividing them**

- PO 1. Build geometric shapes with other common shapes (e.g., tangrams, pattern blocks, geoboards)

## ***STANDARD 5: MEASUREMENT AND DISCRETE MATHEMATICS***

Students make and use direct and indirect measurement, metric and U.S. customary, to describe and compare the real world and to prepare for the study of discrete functions, fractals and chaos which have evolved out of the age of technology.

- **5M-F1. Demonstrate that a single object has different attributes that can be measured in different ways (e.g., length, mass/weight, time, temperature, area and volume)**

PO 1. Determine the characteristics (attributes) of an object that are measurable (e.g., length and weight are measurable; color and texture are not measurable)

PO 2. Identify the type of measure (e.g., weight, height, volume) for each attribute

- **5M-F2. Explain the concepts related to units of measure and demonstrate the process of measurement with non-standard (e.g., using paper clip lengths), U.S. customary and metric units**

PO 1. Select the appropriate unit of measure for a given characteristic of an object  
length - inches, feet and yards;

centimeters and meters

capacity/volume - cups, gallons and liters

mass/weight - ounces, pounds, grams  
and kilograms

PO 2. Select the appropriate tool to measure the given characteristic of an object (e.g., ruler, thermometer, measuring cup, scale)

PO 3. Measure a given characteristic of an object using non-standard units of measure

PO 4. Measure a given characteristic of an object using standard units of measure

PO 5. Tell time to the nearest minute on digital and traditional (analog) clocks

PO 6. Determine the passage of time (i.e., units of days, months and years) using a calendar

PO 7. Compare units of measure to determine *more* or *less* relationships  
length - inches and feet

	feet and yards
	centimeters and meters
capacity -	cups and gallons
mass -	ounces and pounds
	grams and kilograms
time -	minutes and hours
	hours and days
	days and weeks
	months and years
money -	pennies, nickels, dimes, quarters and dollars
PO 8. Compare units of measure to determine equivalent relationships	
length -	inches to feet
time -	minutes to hours
	days to weeks
	months to years
money -	pennies, nickels, dimes, quarters to dollars
PO 9. Read a thermometer in Celsius and Fahrenheit to the nearest degree	

- **5M-F3. Make estimates of measurement**

- PO 1. Estimate a measurement
- PO 2. Compare the estimation to actual measure
- PO 3. Evaluate the reasonableness of the estimation

- **5M-F4. Use discrete mathematical models for graphs to represent everyday situations (e.g., determine how many ways to move from point A to point B on a grid)**

- PO 1. Make a diagram to represent the number of combinations between two sets (e.g., “How many outfits can one make with three different colors of shirts and two different pairs of pants?”)

## ***STANDARD 6: MATHEMATICAL STRUCTURE/LOGIC***

Students use both inductive and deductive reasoning as they make conjectures and test the validity of arguments.

- **6M-F1. Recognize that numbers are used for different purposes in the world and a variety of mathematical notations represent these situations**

PO 1. Formulate mathematical problems from everyday situations

- **6M-F2. Draw inductive and deductive conclusions about mathematics**

PO 1. Extend a pattern using inductive reasoning (e.g., “What is the next number after 2, 4, 6, 8?”)

PO 2. Make a prediction based on existing information (e.g., “All the students in a 3<sup>rd</sup> grade class are under 10 years old. How old will the next new student probably be?”)

- **6M-F3. Distinguish between relevant and irrelevant information**

PO 1. Select the information necessary to solve a given problem

- **6M-F4. Interpret statements made with precise language of logic (e.g., *all*, *every*, *none*, *some*, *or*, *many*)**

PO 1. Use words such as *all*, *every*, *none*, *some* and *many* to make reasonable conclusions about situations